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data

● ● ● ● XLO-1000 STANDARD DATA STORAGE SYSTEM

GENERAL DATA . . .

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SECTION 1
INTRODUCTION

1-1 SCOPE

This document defines the basic configuration and performance characteristics of the Bryant Computer Products XLO-1000 Standard Data Storage System ....

.... a medium-to-large capacity data storage system that is designed for direct connection to a digital computer processor having a low-speed, input/output command channel and a high-speed, input/output memory channel. Data flow from the computer is through the "memory buss" of the computer's high-speed, input/output memory channel.

Basically, the system consists of a controller and a standard, Bryant, rotating, mass-data, storage device. This storage device may be a positioning head disc file (up to 3.8-billion bit capacity), a positioning head drum (up to 340-million bit capacity) or a head-per-track drum (up to 59-million bit capacity), as applicable.

1-2 CONTROLLER

The controller is the controlling unit between the computer and the storage device; it communicates with the computer determining the operations to be performed and the manner in which they are accomplished; it provides the electrical signal interface, synchronization, buffering and command translation necessary to transfer data between the storage device and the computer.

1-3 STORAGE DEVICES

The storage devices provide those elements necessary for the recording, retention and retrieval of control and user data.

1-4 OPTIONS

There are five basic options available for use in the subsystem:

- From one to eight storage devices can be interfaced through the controller.
- Manual switching can be included for connecting the controller to one of two computers.
- By the addition of a second controller, multiple devices can be accessed by two computers without switching.
- Detailed flow charts — tailored to the user's specific computer — can be provided for the diagnostic and peripheral handler routines.
- The diagnostic and peripheral handler routines can be provided in an operational condition on magnetic tape, paper tape, or punched card form compatible with the user's specific computer system.

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SECTION 2
CONTROLLER

2-1 GENERAL DESCRIPTION

The standard controller contains the logic circuits — including control registers — and power supplies that are required to interface the storage device — with its head select/write/read electronics and special function registers — to the computer. The elements of the controller are contained in a separate, free-standing cabinet.

2-2 FUNCTIONAL DESCRIPTION

The controller performs the buffering, timing, control, parity generating and checking, and data formatting functions required to interface the storage device with the computer. Specific functions of the controller are:

- Accept instructions from the computer's programmed command channel.
- Accept and generate synchronizing signals required by the computer and the storage device.
- Receive data from the computer's "memory buss" in a word parallel mode and convert to the data format required by the storage device.
- Receive data in the format of the storage device and assemble data for word parallel transfer to the computer's "memory buss".
- Generate and check parity on transferred data.
- Provide status responses to the computer.
- Provide electrical interfaces compatible with the storage device and the computer.

The interface details defined in the following paragraphs relate to the information flow in and out of the system.

2-2-1 Control Information and Commands

The five units of information required for the control of the subsystem are:

- Controller and device addresses
- Positioner address (for positioning head data storage devices only)
- Head and word or sector address
- Number of words or number of sectors to be transferred
- Starting core address

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2-2-1 Control Information and Commands (Cont.)

The controller responds to four commands. These commands will be coded and decoded by a tailored decoder; an additional line carries a timing signal indicating an external activate condition. The four commands required are:

- Write — Transfer data from core and write on the storage device with header information and check character
- Read — Read data from the storage device, transfer it to core and verify header and check character information
- Clear or reset — Return subsystem to a standby state
- Disconnect — Terminate the subsystem activity after causing the next interrupt condition

2-2-2 Control Operational Sequence

The entire operational sequence is controlled through the command channel of the computer. The address information enables the selection of the controller/storage device combination to be accessed and the selection of a storage device head through which data will be written or retrieved. In the case of a positioning-head storage device (disc file or positioning head drum), the address information positions the heads of the device to a specific track; in a disc file application, the address must then be given to identify the disc surface and frequency zone to be accessed. The number of words or sectors of data that are to be transferred and the starting core position are then transferred from the computer.

2-2-3 Data Transfer Sequence

With the control operational sequence complete, a write or read command from the computer initiates the data transfer in fixed-length word blocks. When less than a full block of data is written, the remainder of the block is filled with ZERO'S. When less than a complete block of data is read, the controller terminates the data transfer but defers the termination of the instruction until the complete block has been read. If an end of track occurs during data transfer, the control unit automatically enables switching to the next data storage track of the device.

Full buffering of the data is accomplished using two buffer registers — a two-way shift buffer register, which communicates with the storage device, and a two-way, input/output buffer register, which communicates with the computer "memory buss".

2-2-3-1 Enabling Data Transfer — Information is transferred from the interface in a "request-reply" manner. The sequence of operation is as follows:

a. The controller makes a "memory request".

b. The computer responds with a "memory available" and an "address line available".

c. The control unit then responds with a "transfer direction" — which indicates that data is to be transferred from or to core — and the corresponding core address.

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2-2-3-2 Write Operation — The following sequence of events occurs if data is to be transferred from core and written onto the data surface of the storage device:

a. The control unit waits for a "data lines available", indicating that data is available to the control unit.

b. The control unit strobes the data from the computer's "memory buss" into its input/output register. The data is then transferred to a device shift buffer register. In standard units, the serial output of this register is applied through a write parity generator to a write amplifier. The amplified data is then inductively coupled through the selected write/read head onto the magnetic coated surface of the storage device.

c. When the data transfer is completed and detected through the word count register, the control unit issues a "data accepted" signal and resets the "memory request" and "transfer direction" levels.

d. The computer resets the "address lines available" and "data lines available" signals and the control unit resets the "data accepted" line.

2-2-3-3 Read Operation— The following sequence of events occur if data is to be read from the data surface of the storage device and transferred to the core:

a. The control unit waits for a "data lines available", and then enables the data lines.

b. Data magnetically stored on the data surface of the storage device is read serially through the selected write/read head and amplified. The shaped amplified data is applied through a parity checker into the device shift buffer register and then transferred through the input/output buffer register to the "memory buss" of the computer.

c. When the data transfer is completed and detected through the word count register, the computer issues a "data strobed" signal, indicating the data has been accepted, and resets the formerly set levels.

2-2-4 Status Information and Interrupt Conditions

The status of various circuits in the data storage system are indicated through status registers. One of two completion conditions can occur; normal or abnormal, each resulting in a unique interrupt signal being sent to the computer by the controller. The cause of an abnormal interrupt may be determined through status register interrogation. The conditions causing the generation and transmission of the interrupt signal are as follows:

a. When the heads of a positioning head device fail to index to the proper track, prerecorded track coding in the header of the data track will not properly match the applied positioning address in the status register thereby resulting in the generation of an abnormal interrupt during the address phase of operation.

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2-2-4 Status Information and Interrupt Conditions (Cont.)

b. Parity is generated following each word that is to be written onto a storage device. During the read operation parity is again generated and compared to that previously recorded during the write cycle. A discrepancy will result in an error condition causing an abnormal interrupt.

c. If data is coincidentally absent from both the input/output buffer register and the device shift buffer register, or if a previous cycle request has been acknowledged before the controller requests another memory cycle, a high speed channel overrun is sensed by the status registers resulting in the generation of an abnormal interrupt.

d. The word count register is decremented each time a word is transferred during a write or read operation. When the last word is in the process of being transferred, a normal interrupt signal is generated. This signal preludes the generation of a clear/reset command from the computer to the controller immediately after transfer of the last data word or block thereby returning the controller to the standby state of the operational sequence.

2-3 GENERAL SPECIFICATIONS

2-3-1 Cabinet

In the case where the controller elements are contained in a free standing cabinet, the cabinet will measure approximately 26-inches wide, 36-inches deep, and 80-inches high.

2-3-2 Electronic Circuit Cards

A complete family of cards designed specifically for use with Bryant's data storage systems make up the logic circuits of the controller. The cards — designated Bryant's Series 9000, utilizing TTL monolithic integrated circuit elements and, as applicable, discrete elements — are capable of operating at five megaHz synchronous clock rates and at temperatures ranging from 0° to 70°C.

Due to the nature of the computer to which the data storage system is to be mated, electrical compatibility with any computer will be provided by means of optional signal and level translators, thereby satisfying the computer interface requirements.

2-3-3 Power Requirements

A 105- to 132-volt, 47- to 63-Hz, 1000-watt (approximate), single-phase power source is required by the circuits of the controller.

2-3-4 System Control and Monitoring Provisions

Switches and control circuits for local or remote turn-on of the system, indicators for identifying system operating status, controls for resetting system protective circuits, and the like, are available as a part of the standard system.

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2-3-5 Options

If a parallel write/read capability is desired and if the selected storage device can operate within the desired parallel capability, the controller can be designed to accommodate such data transfer at the user's option. Also, if independent head system options are selected in the case of the positionable head system devices, the controller can be adapted to accommodate such options.

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SECTION 3
STORAGE DEVICES

3-1 INTRODUCTION

Either a Bryant Model 2A Series 4000 Disc File, a Positioning head Drum (PhD), or a Bryant Auto-Lift Drum is proposed for use in Bryant's XLO-1000 Time Sharing Data Storage System. A brief description of each storage device follows.

3-2 MODEL 2A SERIES 4000 DISC FILE

Six zone, three-frequency format, C- and A-frame Model 2A Series 4000 disc files — with data storage capacities of 3.8 and 1.8 billion bits, respectively — are available for use in the standard data storage system. Six zone, six-frequency format configurations — which yield 7.9% greater capacities — are available at the customer's option.

3-2-1 General Description

The C-frame Model 2A Series 4000 Disc File is a three cabinet, environmentally controlled, random access, modular, positioning-head, mass-data, storage device that is capable of accommodating the installation of from one to 25 data storage discs. The A-frame device is identical to the C-frame device except that it includes only two cabinets and it can only accommodate the installation of from one to 12 data storage discs. Both disc file configurations contain multiple write/read data heads (six heads serving each surface of every data disc) each of which are coincidentally positionable to 256 discrete positions. Each head, in turn, is capable — upon selection and through positioning — of magnetically recording on and retrieving from rotating disc surface(s) a total of 256 tracks of digital data. Included in the file makeup are head select/write/read electronics and special function registers that are designed to interface the storage device with the controller.

3-2-2 Functional Description

During the address phase of the controller's operation, the heads of the disc file are positioned to the track at which a write or read operation is to be performed. For standard systems, one of as many as 300 write/read data heads (C-frame disc file with full 25 data disc complement) or 144 write/read data heads (A-frame file with full 12 data disc complement) is selected for the write or read operation. Upon controller's receipt of the write command, the events of paragraph 2-2-3c.(1) occur to enable word(s) or block(s) of data to be written — in the form of a track — onto the rotating data disc surface. Similarly, upon controller's receipt of the read command, the events of paragraph 2-2-3c.(2) occur to enable a word(s) or block(s) of data — previously written in the form of a track — to be read from the rotating data disc surface.

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3-2-3 General Specifications

The following paragraphs furnish general information relative to the specifications of the Model 2A Series 4000 Disc Files.

3-2-3-1 Data Storage Capacity — The data storage capacities of the six-zone, three-frequency format C- and A-frame disc files — considering full data disc complements and bit packing densities of 600 bits-per-inch (bpi) in the inner two zones and 800bpi in the outer four zones of the disc surface — are approximately 3.8- and 1.8-billion bits, respectively; the bits that are accessible through the full complement of heads of each file through head switching — without positioning — are 14, 764,000 and 7,086, 720 bits, respecitvely. For additional details regarding the storage capacity of disc files, refer to Bryant's data sheet entitled "Model 2A Series 4000 Disc File", Publication No. BCP-2-004-11-66.

3-2-3-2 Cabinets — The head select/write/read electronics furnished with the disc file are housed in the front-center compartment of the disc file cabinet. Added space for housing electronic components is optionally available in the form of an auxiliary electronics cabinet that is attachable to the disc file cabinet of either the C- or A-frame disc file configurations. For further details with regard to the cabinets of the disc file, refer to Bryant's data sheet, Publication No. BCP-2-004-11-66.

3-2-3-3 Electronic Circuit Cards — The electronic circuit cards used in the head select/write/read circuits and special function registers of the disc file are Bryant's Series 9000 as described in paragraph 2-3-2. For additional details regarding the head select/write/read electronics of the disc file, refer to Bryant's brochure entitled "2A, Largest Unit Capacity — Lowest Cost Per Bit — The Bryant Model 2A Series 4000", Publication No. BCPB-112-4-66.

3-2-3-4 Power Requirements — A 208-, 220- or 440-volt, three-phase, 60 Hz or 380- or 415-volt, three-phase, 50 Hz power source is required for the electro/hydraulic/mechanical assembly; a transformer can be provided in the configuration to enable step-down of the main input power to satisfy the 105- to 132-volt, single-phase, 47- to 63-Hz power requirements of the electronic circuits of the storage device.

3-2-3-5 Disc File Control and Monitoring Provisions — Switches and control circuits for performing local or remote turn-on and indicators for identifying operating status of the disc file are available as a part of the standard disc file package.

3-2-3-6 Options — A dual, independent positioning head system disc file — offered in the C-frame file configuration only, parallel write/read operation, and additional fast access data heads are available as options to the user.

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3-3 POSITIONING HEAD DRUM (PhD)

Bryant's family of Positioning head Drums (PhD) .... individual drums with one or two independent positioning head systems within the one drum enclosure .... are available for use in the standard data storage system.

3-3-1 General Description

The Positioning head Drum (PhD) is a two cabinet, random access, mass data storage device that is capable of accommodating the installation of a single data storage drum having as many as four, independently positionable, write/read, data head systems. Each head system contains multiple write/read heads. The head systems are designed such that the tracks of data accessed by the heads of one head system can be simultaneously and/or independently accessed by the corresponding heads of any of the other head systems!! Such a capability, with maximum complement of head systems, enables: (1) the entire storage capability of the device to be coincidentally and independently accessed by as many as two computer processors; (2) a single processor, with proper queueing, to access the total data store of the device in an extremely short period of time; or (3) a redundancy capability never before possible in any other data storage device on the market. The heads of a head system are coincidentally positionable to 64 or 128 discrete positions. Each head, in turn, is capable — upon selection and through positioning — of magnetically recording on or retrieving from the rotating drum surface a total of 64 or 128 tracks of digital data. Included in a PhD that is designed for use in the standard data storage system are the head select/write/read electronics and special function registers that are designed to interface the head system of the storage device to the controller.

3-3-2 Functional Description

During the address phase of the controller's operation, the heads of the head system of the drum are positioned to the track at which a write or read operation is to be performed. For a standard system, one of as many as 43 heads is selected for the write or read operation. Upon the controller's receipt of the write command, the events of paragraph 2-2-3c.(1) occur to enable words or blocks of data to be written — in the form of a track — onto the rotating drum surface. Similarly, upon controller's receipt of the read command, the events of paragraph 2-2-3c.(2) occur to enable word(s) or block(s) of data — previously written in the form of a track — to be read from the rotating drum surface.

3-3-3 General Specifications

The following paragraphs furnish general information relative to the specifications of the PhD-340.

3-3-3-1 Data Storage Capacity — The data storage capacity of the PhD-340 — considering bit packing densities of 1000 bits-per-inch — is 340 million bits; the bits that are available to the full complement of heads of the head system — without positioning — are

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3-3-3-1 Data Storage Capacity (Cont.)

2,700,000 bits. For additional details regarding the means of achieving this storage capacity, refer to Bryant's brochure entitled, "Bryant PhD Random Access Mass Storage Drums", Publication No. BCPB-111-11-65.

3-3-3-2 Cabinets — One of the two cabinets of the PhD houses the drum proper. The other cabinet, which locks to the drum cabinet, houses the head select/write/read electronics and special function registers of the PhD. For further details with regard to the cabinets of the PhD, refer to Bryant's PhD Brochure, Publication No. BCPB-111-11-65.

3-3-3-3 Electronic Circuit Cards — The electronic circuit cards used in the head select/write/read circuits and special function registers of the PhD are Bryant's Series 9000 line as described in paragraph 2-3-2. For additional details regarding the head select/write/read electronics of the PhD, refer to Bryant's PhD Brochure, Publication No. BCPB-111-11-65.

3-3-3-4 Power Requirements — A 208-volt, three-phase, 60-Hz or a 380-volt, three-phase, 50-Hz power source is required for the electro/hydraulic/mechanical assembly; a transformer can be provided in the configuration to enable step-down of the main input power to satisfy the 105- to 132-volt, single-phase, 47- to 63-Hz, power requirements of the electronic circuits of the storage device.

3-3-3-5 PhD Control and Monitoring Provisions — Switches and control circuits for performing local or remote turn-on and indicators for identifying operating status of the PhD are available as a part of the standard PhD package.

3-3-3-6 Options — Head positioning systems can be added to the standard drum. In fact, one additional, independent, head positioning system can be added, and added such that the heads of each head system can have access to the same tracks of data as the corresponding heads of any other head system, at the same time!! Also available are additional fast access data heads.

3-4 AUTO-LIFT DRUMS

Bryant's family of Auto-Lift Drums .... devices with medium data storage capacities .... are available for use in the standard data storage system. Capacity of the largest design of this type of drum is in access of 59-million bits.

3-4-1 General Description

When used in the XLO-1000 Data Storage System, the Auto-Lift drum is furnished as a single cabinet, random access, head-per-track, data storage device. Three standard series of drums are available for use in the system. These are the Series 75000, 10000, and 185000. Within each series, there is a selection of standard write/read data head combinations. In the Series 75000 drum line, the largest drum of the line can accommodate a maximum of 256

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3-4-1 General Description (Cont.)

write/read heads. In the Series 10000 drum line, the largest drum of the line can accommodate a maximum of 512 write/read heads. In the Series 185000 drum line, the largest drum of the line can accommodate a maximum of 1024 write/read heads. Each head of a drum series is capable — upon selection — of magnetically recording on and retrieving from the drum surface a finite number of bits of digital data; the number of tracks of data available are equal to the number of write/read data heads that are furnished with the drum. Included in the drum make-up are head select/write/read electronics and special function registers that are designed to interface the storage device with the controller.

3-4-2 Functional Description

During the address phase of the controller's operation, one head of the drum's full head complement is selected for the write or read operation. Upon controller's receipt of the write command, the events of paragraph 2-2-3c.(1) occur to enable words or blocks of data to be written — in the form of a track — onto the rotating drum surface. Similarly, upon controller's receipt of the read command, the events of paragraph 2-2-3c.(2) occur to enable a word or block of data — previously written in the form of a track — to be read from the rotating drum surface.

3-4-3 General Specifications

The following paragraphs furnish general information relative to the specifications of the Auto-Lift Drum product line.

3-4-3-1 Data Storage Capacity — The data storage capacity of the Auto-Lift Drum product line varies depending on the drum series and model. The capacities of the largest drums of each series — considering bit packing densities of 1000 bits-per-inch — are as follows: Model 75256, 6-million bits; Model 10512, 16-million bits; and Model 1851024, 59-million bits. Unlike the positioning head devices wherein access to the entire data store is possible only through head positioning, the full data storage capacity of an Auto-Lift drum is available by merely initiating head switching. For additional details regarding the means of achieving the storage capacity of the drums, refer to Bryant's brochure dealing with Auto-Lift Drums.

3-4-3-2 Cabinets — When supplied with a system, the storage device is furnished as a cabinet. The cabinet is divided into two compartments. The drum is mounted in one compartment and the head select/write/read electronics and special function registers are mounted in the other compartment.

3-4-3-3 Electronic Circuit Cards — The electronic circuit cards used in the head select/write/read circuits and special function registers of the Auto-Lift Drum are Bryant's Series 9000 line as described in paragraph 2-3-2.

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3-4-3-4 Power Requirements — Depending of the drum series, a 115- or 208-volt, single- or three-phase, 60-Hz or 380-volt, single- or three-phase, 50-Hz power source is required for the electro/mechanical assembly; a transformer can be provided in the configuration to enable step-down, as applicable, of the main input power to satisfy the 105- to 132-volt, single-phase, 47- to 63-Hz, power requirements of the electronic circuits of the storage device.

3-4-3-5 Options — Switches and control circuits for performing local or remote turn on and indicators for identifying operating status of the drum are available as a part of the standard Auto-Lift Drum package that is furnished as a part of the complete subsystem. Parallel write/read operation is also offered as an option.

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SECTION 4
SYSTEM OPTIONS

4-1 INTRODUCTION

The controller of the XLO-1000 Standard Data Storage System can handle — at the customers option — multiple data storage devices or dual computers. In addition, diagnostic and peripheral handler routines — developed for the specific data storage system installation — are also available.

4-2 MULTIPLE STORAGE DEVICE SYSTEM

As many as eight data storage devices can be controlled through the basic controller of the XLO-1000 Data Storage System. Though only one storage device can be accessed by the computer at any one time through the controller, the controller could be designed to enable — in the case of a positionable head device — the positioning of the heads of a second device while the first selected device is being used in a write/read operation.

4-3 SERVICING DUAL COMPUTERS

Through a manual switching arrangement, one controller could interface the storage devices with as many as two computers, though only one of the two computers would be able to access the storage devices of the system at one time. Through the addition of a second controller, however, the storage devices could be coincidentally accessed by both computers through both computers would not be able to simultaneously access the same storage device at the same time — that is, unless multiple head system PhD data storage devices are utilized within the system.

4-4 DIAGNOSTIC AND PERIPHERAL HANDLER ROUTINES

The XLO-1000 Data Storage System can be supported with a comprehensive diagnostic and peripheral handler subroutine package — a package that can truly complement the modularity and flexibility of the system. The subroutines can be furnished in the form of either detailed flow charts or they can be provided in an operational condition on magnetic tape, paper tape, or punched cards — with either option tailored to the user's specific computer.

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